Landscape Unit Planning

Implementation Cost Estimate

A Report to the BC Ministry of Forests
Forest Practices Branch
by
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Executive Summary

This report provides an assessment of the expected costs that can be attributed to implementing priority biodiversity elements of Landscape Unit Planning, namely Wildlife Tree Patches and Old Growth Management Areas. Three cost pilots were undertaken, one on the coast and two in the interior. The coastal pilot was conducted in the Campbell River Forest District, with cooperation from Canfor, Interfor, and the Ministries of Forests and Environment. The interior pilots were conducted in the Prince George Forest District with Ministry of Forests staff and Canfor, and in the Kootenay Lake Forest District with the Ministries of Forests and Environment and Crestbrook Forest Industries.

The methodology adopted for this exercise was to stratify the landscape units throughout the province into cost categories, as a basis for reducing the variability of cost impact estimates. Cost estimates were then developed for those cost categories based upon detailed analysis of sample landscape units. Results from these two exercises were then combined to estimate a weighted cost estimate for the interior and for the coastal regions of the province.

Two cost categories were recognized, fixed and variable. Fixed cost factors are founded upon the basic assumption that there are certain fixed costs to develop and maintain an operating presence in a landscape unit or cut block. Variable costs are costs that are only incurred through active operations such that if there were no operations there would be no variable costs. Variable costs occur at the block level and are impacted by wildlife tree patches, while fixed costs occur at both the block and landscape level and are impacted by both wildlife tree patches and old growth management areas. Table 1 below summarizes project results for the province and for appraisal regions.

Table 1: The Estimated Costs of Implementing Old Growth Management Areas and Wildlife Tree Patches

Crown Forest Stratification		Incremental Cost ($/m3)	Incremental Fixed Cost ($/m3)		Incremental Variable Cost ($/m3)
Cost Class	BEO	fixed & variable	OGMAs	WTPs	
Province					
1	all	$0.76		$0.47	$0.29
2	L	$0.87	$0.11	$0.47	$0.29
2	I	$1.26	$0.50	$0.47	$0.29
2	H	$1.57	$0.80	$0.47	$0.29
Province average:		**$1.04**	**$0.28**	**$0.47**	**$0.29**
Interior					
1	all	$0.88		$0.50	$0.38
2	L	$1.03	$0.15	$0.50	$0.38
2	I	$1.50	$0.62	$0.50	$0.38
2	H	$1.91	$1.03	$0.50	$0.38
Interior average:		**$1.27**	**$0.39**	**$0.50**	**$0.38**
Coast					
1	all	$0.47		$0.41	$0.06
2	L	$0.49	$0.02	$0.41	$0.06
2	I	$0.67	$0.20	$0.41	$0.06
2	H	$0.72	$0.25	$0.41	$0.06
Coast Average:		**$0.51**	**$0.04**	**$0.41**	**$0.06**

1.0 Introduction

1.1. Task Definition

This report provides an assessment of the expected costs that can be attributed to implementing priority biodiversity elements of Landscape Unit Planning, namely Wildlife Tree Patches and Old Growth Management Areas. In continued efforts to balance the conservation objectives of the *Forest Practices Code of BC Act* with the associated operational costs, the Forest Practices Branch of the BC Ministry of Forests has commissioned this review of implementation costs.

In addition to the estimation of costs, this project also is intended to identify opportunities for mitigation and avoidance of cost impacts. As well, mechanisms are suggested that can be used to shift the increased costs incurred by the forest sector due to government decisions, from industry to government. It is within this context that estimates and suggestions are put forward in this report. The primary objectives of this report are to:

- Provide cost per cubic meter estimates of implementing Wildlife Tree Patches (WTPs) and Old Growth Management Areas (OGMAs) in the interior of the province,
- Provide cost per cubic meter estimates of implementing WTPs and OGMAs in the coastal regions of the province,
- Provide an assessment of opportunities to avoid or lessen the cost impact of implementing these code provisions, and
- Provide recommendations for mechanisms to transfer the cost to the forest sector of social decisions taken by government from industry to government, where appropriate.

The current code provisions represent a partial set of recommendations that are contained in the biodiversity guidebook, and it is inevitable that similar cost benefit decisions lie ahead for this and future administrations. Hopefully, this report can provide ongoing utility in addressing these difficult choices. Venture Forestry Consulting Inc. appreciates the opportunity to assist the Forest Practices Branch in its quest for balance in forest stewardship decisions.

1.2. Task Limitations

The estimation of provincial cost impacts resulting from implementation of biodiversity provisions is difficult to do in isolation of the many factors and varied circumstances that exist in British Columbia. This task is complicated by higher-level plan objectives that over-ride implementation of guidebook provisions, varied silviculture systems that provide for differing levels of biodiversity at the landscape level, interim or incomplete biodiversity emphasis option designations from land use planning processes and unique operational realities of individual forest operations.

Many assumptions are necessary to deal with complex inter-relationships that exist amongst factors such as these. These assumptions are not made with any claim to statistical reliability. Rather, they are based upon the experience and knowledge of project participants, and upon the acceptance of assumptions proposed to those participants by the consulting parties involved.

Ministry of Forests and forest sector staff were involved as participants in all stages of the project, as were Ministry of Environment staff directly or indirectly. The complexity and timeframe of this project limits the reliability of results to "order of magnitude" estimates with ranges of expected variation. The names of project participants are in Appendix 4.

2.0 Methodology and Results

The methodology chosen was to stratify the landscape units throughout the province into cost categories, as a basis for reducing the variability of cost impact estimates. Cost estimates were then developed for those cost categories based upon detailed analysis of sample landscape units. Results from these two exercises were then combined to estimate a weighted cost estimate for the interior and for the coastal regions of the province.

During the costing process, opportunities to reduce or even eliminate cost impacts were sought and documented. Recommendations were provided based upon input from project participants within the government and the forest industry.

Mechanisms for mitigating industry costs were outlined based upon the timber valuation process in place for stumpage determination in the province and upon a direct cash offset of stumpage payable.

2.1. Key Assumptions

To complete the assigned task in the time allowed, four basic assumptions were made in development of the project methodology. These assumptions are fundamental to this report and include the area:volume assumption, the fixed and variable cost assumptions and the assumption related to timing of costs. Together, these assumptions form the basis of the estimates jointly developed by industry and government staff, and described in the report appendices.

The *area:volume assumption* assumes that for a given landscape unit, the area of Timber Harvesting Landbase (THLB) that is included in Old Growth Management Areas (OGMAs) and Wildlife Tree Patches (WTPs) is representative of the average timber profile. Thus a percentage decrease in THLB area represents the same percentage decrease in available volume within that landscape unit. THLB reduction results in an immediate available volume decrease and a permanent growing capacity decrease. This reflects that the total volume available for harvest *over any timeframe* is reduced by a factor equivalent to the ratio of the revised THLB to the original THLB, when OGMAs and WTPs are established within a landscape unit.

The *fixed cost assumption* assumes that there are certain fixed costs of operating in a landscape unit that will be essentially unchanged by a volume reduction brought about by the proposed THLB reduction due to OGMAs and WTPs. These costs are largely comprised of transportation infrastructure costs, but include fixed portions of other operating costs such as camps, road maintenance and planning. Given the magnitude of the change proposed by landscape unit planning, fixed costs are assumed to be independent of the rate of harvest in a landscape unit.

The fixed cost assumption works in conjunction with the area:volume assumption to estimate *change in the fixed unit cost* attributable to the above factors. Given that the total fixed costs remain constant after implementation, and that the volume is decreased proportionally to the decrease in THLB, the unit cost increase for any timeframe is determined as follows:

Fixed unit cost increase = (fixed cost / reduced volume) - (fixed cost / original volume)

For example, an operator with an AAC of 100,000 cubic metres and an experienced fixed unit cost of $10.00 per cubic metre would have an annual fixed cost of one million dollars. If that operator's THLB were decreased by 10% then 90,000 cubic metres would be available from that same landbase for the same level of expenditure.

Fixed unit cost increase = (1,000,000 / 90,000) - (1,000,000 / 100,000) = $1.11 per cubic metre

The *timing of costs assumption* reflects that cost increases are immediate following the implementation of OGMAs and WTPs in a landscape unit. When these constraints to THLB are enacted, they immediately constrain the remaining available timber from a cut block and/or a landscape unit. At this point in time the ratio of original THLB to revised THLB is established, and that in turn is the basis of the unit cost impact estimate.

The *variable cost assumption* assumes that variable costs are those that are dependent upon harvesting activity, such that if there were no harvesting there would be no variable costs.

2.2. Landscape Unit Cost Classes

Three cost classes were proposed, one on either end of the extreme range of variance, and a third intended to be representative of the majority of landscape units. These three cost categories are defined as follows:

- At the low end of the scale are landscape units that are expected to have enough old seral stage forest cover outside the timber harvesting landbase to meet old growth targets.
- The main category includes landscape units that will require a contribution of area from the timber harvesting landbase to meet old growth targets. This category of landscape units was then stratified into high, intermediate and low biodiversity emphasis designations.
- At the high end of the scale are landscape units that will incur unusually high cost impacts related to loss of sunk costs. Examples of class three costs could be significant abandoned road development or planning costs, or lost amortization opportunity due to early equipment replacement made necessary by changed timber profile or logging chance.

Landscape units were divided between the first two cost classes based upon information provided by Forest Districts during the development of Regional Landscape Unit Planning Strategies (RLUPS). While a great deal of information has been collected for the RLUPS exercise, this was not done consistently and thus finer stratification of landscape unit cost categories was not appropriate. Where land use planning has established biodiversity emphasis options the results were generally incorporated into district summaries.

Where land use planning had not designated biodiversity emphasis the provincial target of 10%, 45% and 45% respectively for high, intermediate and low biodiversity emphasis was used.

Table 2: Cost Class Strata

Landscape Unit Stratification		%	Crown Forest Area (ha)						
Cost Class	BEO		Total	PRFR	PGFR	CFR	KFR	NFR	VFR
	4								
Province									
1	all	28.9%	10,760,775	1,354,003	3,145,546	735,138	516,005	761,601	4,248,481
2	L	27.1%	10,080,985	541,814	4,908,358	1,686,870	1,635,675	1,095,093	213,174
2	I	34.7%	12,922,016	306,523	6,673,043	2,134,108	1,704,557	1,266,430	837,355
2	H	9.3%	3,444,712	62,018	1,749,311	567,647	430,726	397,578	237,431
			37,208,487	2,264,358	16,476,259	5,123,763	4,286,964	3,520,702	5,536,442
Interior									
1	all	19.0%	5,918,533	760,243	3,145,546	735,138	516,005	761,601	
2	L	31.7%	9,865,594	539,597	4,908,358	1,686,870	1,635,675	1,095,093	
2	I	38.9%	12,084,250	306,112	6,673,043	2,134,108	1,704,557	1,266,430	
2	H	10.3%	3,207,280	62,018	1,749,311	567,647	430,726	397,578	
			31,075,657	1,667,970	16,476,259	5,123,763	4,286,964	3,520,702	
Coast									
1	all	79.0%	4,842,241	593,760					4,248,481
2	L	3.5%	215,391	2,217					213,174
2	I	13.7%	837,766	411					837,355
2	H	3.9%	237,431						237,431
			6,132,830	596,388					5,536,442
			2	1	1	1	2	1	

footnotes:

1 from RLUPS district summary (complete)
2 from RLUPS district summary (partial)
3 from regional or provincial averages
4 biodiversity emphasis option

Landscape units in the third cost class were not stratified out in the sampling process, as there was not sufficient time to seek out individual circumstances that would lead to unusually high implementation costs. Instead, these landscape units are to be identified for special treatment as they are encountered in the implementation process. Cost class three situations are expected to be infrequent.

Landscape units were stratified for each Forest District and then combined by Forest Region and again by geography between the coast and interior of the province. Not all districts were able to provide appropriate landscape unit information in the timeframe required; thus approximately 70% of the provincial crown forested area excluding parks is included in the stratification sample. However, districts excluded are Invermere, Golden, Cassiar, Kalum and Kispiox. These districts comprise 15 million hectares of gross area but contribute less than 3% to provincial AAC. Approximately 97% of the provincial AAC is represented in the sample. This breakdown of the provincial forested landbase was used to weight stratified cost estimates developed through cost pilots.

2.3. Cost Pilots

Three cost pilots were undertaken, one on the coast and two in the interior. The coastal pilot was conducted in the Campbell River Forest District, with cooperation from Canfor, Interfor, and the Ministries of Forests and Environment. The interior pilots were conducted in the Prince George Forest District with Ministry of Forests staff and Canfor, and in the Kootenay Lake Forest District with the Ministries of Forests and Environment and Crestbrook Forest Industries. The first cost pilot was conducted in Prince George to develop a costing methodology and the two subsequent pilots were carried out using that same methodology. Three cost pilots were all that could be carried out in the time frame allotted to this work. Three diverse pilot areas were chosen based largely upon varied circumstances and geographic distribution across the province. Within pilot areas a cross-section of landscape units was chosen to represent regional conditions.

The methodology adopted recognizes two cost categories, fixed and variable. Fixed costs although unchanged in magnitude by Landscape Unit Planning provisions, incur unit cost increases when volume reductions occur from losses of timber harvesting landbase (THLB) due to either OGMAs or WTPs. Variable costs are costs that are only incurred through active operations such that if there were no operations there would be no variable costs. The pilot methodology looked for instances where variable unit costs could be expected to change due to OGMAs or WTPs. All costs were derived from appraisal manual estimates where feasible in order to preclude local bias. Where appraisal manual cost estimates were not directly applicable, cost survey information was used as a second choice. As a third option the experienced costs of industry participants were used.

Fixed costs identified included road infrastructure costs, camps, equipment moving costs, plus portions of road maintenance and planning costs. Costs for road maintenance and camps were taken directly from the manual, and planning costs were based upon the percentage of appraisal manual overhead costs that result from planning activities captured in the log cost survey of the industry participant.

Road costs for the interior were based upon an averaging of 340 active cutting permits distributed across the interior while coastal road costs were based upon the 1996 KPMG cost driver study. Road cost increases result both from WTPs at the site level and from OGMAs at the landscape level. (Appendix II)

Variable costs identified included planning costs, road costs, tree to truck costs and hauling costs. Not all cost pilots identified costs in all categories. Costs that were identified represented an expected unit cost increase for particular elements of a cost phase and were based largely on estimates of harvesting productivity losses. These costs are site level costs related to WTPs. (Appendix II)

2.4. Fixed-Cost Factors

Fixed cost factors in this section are founded upon the assumptions described in section 2.1. First, the fixed cost assumption is that there are certain fixed costs to develop and maintain an operating presence in a landscape unit. These costs will increase on a unit basis if the volume attributable to them is decreased. Second, the area:volume assumption is that a percentage decrease in THLB area represents the same percentage decrease in available volume within that landscape unit. Thus the THLB area loss to landscape unit planning represents the percentage volume loss in a given landscape unit. The fixed or independent portion of post landscape unit planning cost per cubic meter is estimated by applying the identified fixed costs to a reduced available harvest volume. For example, if a licensee was operating in nine landscape units at the time OGMAs and WTPs were implemented, that licensee would no longer be able to harvest the same volume from those nine landscape units. However, since the fixed costs are unchanged for that decreased volume, the fixed unit cost of operating in those nine landscape units is increased. To replace the lost volume the licensee is required to operate in a tenth landscape unit. If OGMAs and WTPs are required in the tenth landscape unit then the fixed unit cost there will be impacted just as it was the first nine.

For landscape units classified as cost class one there was no THLB impact from OGMAs by definition, and only landscape level cost factors from WTPs were attributed to this class. For landscape units classified as cost class two there is an expected cost increase based upon a THLB impact from OGMAs as well. Based upon this logic, fixed cost factors at the landscape level vary by the degree to which WTPs and OGMAs impacted THLB. This in turn is significantly influenced by the biodiversity emphasis option assigned to the landscape unit.

Separate fixed cost factors were developed for High, Intermediate and Low biodiversity emphasis options in the interior and on the coast by estimating the relative percentage timber harvesting landbase impact in each instance (Table 3).

Table 3: Fixed Cost Factors

Forest Region	Cost Strata		Fixed Cost Factors	
	cost class	BEO	OGMA factor	WTP factor
Prince George	1	all		0.035
	2	L	0.001	0.035
	2	I	0.042	0.035
	2	H	0.085	0.035
Nelson	1	all		0.029
	2	L	0.027	0.029
	2	I	0.075	0.029
	2	H	0.109	0.029
Interior (PG & Nelson)	1	all		0.032
	2	L	0.014	0.032
	2	I	0.059	0.032
	2	H	0.097	0.032
Coast (Vancouver)	1	all		0.020
	2	L	0.002	0.020
	2	I	0.024	0.020
	2	H	0.030	0.020

2.5. Provincial Cost Estimates

In estimating expected variable cost increases, estimates were simply accumulated and averaged across the samples. One variable cost estimate increase was developed for the interior and another was developed for the coast. These costs apply unilaterally as they accrue from WTPs that are a general requirement across all landscape units.

The unit fixed cost is expected to increase both at the block level and the landscape level due to THLB losses to OGMAs and WTPs. At the block level equipment moving costs, road costs and planning costs are expected to increase due to fixed cost impacts of WTPs and this cost will be applied universally across all landscape units, as WTPs are a general requirement across all landscape units. At the landscape level, road and road maintenance costs, camp costs and landscape level planning costs are expected to increase due to fixed cost impacts of WTPs. Thus, fixed cost increases and variable cost increases from WTPs are both applied to all landscape units (Table 4).

Table 4: Fixed and Variable Cost Increases

Forest Region	Cost Strata		Fixed Cost Increase $/m^3	Variable Cost Increase ($/m^3)
	cost class	BEO		
Prince George	1	all	0.53	0.10
	2	L	0.54	0.10
	2	I	0.98	0.10
	2	H	1.44	0.10
Nelson	1	all	0.45	0.67
	2	L	0.74	0.67
	2	I	1.25	0.67
	2	H	1.60	0.67
Interior (PG & Nelson)	1	all	0.50	0.38
	2	L	0.65	0.38
	2	I	1.12	0.38
	2	H	1.53	0.38
Coast (Vancouver)	1	all	0.41	0.06
	2	L	0.43	0.06
	2	I	0.61	0.06
	2	H	0.66	0.06

Also at the landscape level, road and road maintenance costs, camps costs and landscape level planning costs are expected to increase due to fixed cost impacts of OGMAs. Fixed costs resulting from OGMAs apply to only cost class two landscape units. Fixed unit costs from OGMAs are estimated for each biodiversity emphasis option by weighting cost factors of cost class two landscape units by the area that falls within each biodiversity emphasis option. This weighted cost is added to the universally applied variable cost estimates to provide an estimate of landscape unit planning implementation costs.

Cost samples for the interior were averaged to provide an interior cost estimate and questions were raised regarding the equal weighting of the samples. There was no clear volume basis for weighting the unit cost estimates from these samples as rate of cut numbers are not specific to landscape units. As well, variance in costs can be influenced significantly by implementation approaches that are region and district specific. Although not systematically tested, the Prince George and Kootenay Lake examples appear to address the range of local implementation approaches in the interior. As a result of this uncertainty, a sensitivity analysis was done to determine the significance of this weighting. Table 5 below shows the range of variation in the interior cost estimate given different sample weightings. There is a 17% range either side of the estimated interior mean unit cost increase, based upon a 30% range in sample weighting either side of equal weighting.

Table 5: Sensitivity of Interior Cost Estimate to Sample Weighting

Cost	Pilot	$/m3			
Kootenay Lake	Prince George	Total	Fixed Costs		Variable Costs
Cost Pilot	Cost Pilot	Interior	OGMA	WTP	WTP
20%	80%	1.05	0.32	0.52	0.21
30%	70%	1.13	0.34	0.51	0.27
40%	60%	1.20	0.37	0.50	0.33
50%	50%	1.27	0.39	0.50	0.38
60%	40%	1.34	0.42	0.49	0.43
70%	30%	1.42	0.44	0.48	0.50
80%	20%	1.49	0.47	0.47	0.55

3.0 Opportunities for Minimizing the Cost Impacts

The costs of implementing WTPs and OGMAs can be significantly varied by the choices made in the way these elements of biodiversity landscape unit planning are implemented. The greatest opportunity to control implementation costs is to avoid THLB reductions, and there is significant opportunity to do this. The following are suggestions that need to be evaluated for both the magnitude of the potential cost saving and the effect they may have on the goals of the biodiversity guidebook. The suggestions consider the cost of implementation alone, and are not intended to be an evaluation of the conservation value of varied approaches to implementation.

Some of the suggestions listed below are already being implemented in some regions of the province. Other suggestions are new and not currently being considered in the establishment of either WTPs or OGMAs.

3.1. Wildlife Tree Patches

3.1.1. Establish Wildlife Tree Patches on the Perimeter of Cut Blocks

In order to minimize the cost of WTPs locate the patch on the perimeter of the cut block. By doing so the impacts of yarding or skidding around these patches is minimized. This is especially true in cut blocks that will be harvested using cable systems. Establishing the WTPs on the perimeter also has the effect of eliminating volume that must be yarded or skidded the longest distance and thus at higher harvesting cost.

3.1.2. Establish Wildlife Tree Patches in Areas with difficult Logging Chance

By locating a WTP in an area of difficult harvesting the negative impact other WTPs have on harvesting costs can be somewhat offset. For example a WTP located in a difficult draw that would provide harvesting challenges will help offset the additional cost of harvesting the ground located between a WTP and the boundary.

3.1.3. Establish Wildlife Tree Patches in Low Volume Stands

Locating WTPs in low volume stands on a priority basis can lessen the cost increase due to the loss of timber harvesting landbase. Fixed cost increases are related directly to volume not area and a lower volume per hectare loss will result in a lower unit cost increase.

3.2. Old Growth Management Areas

3.2.1. Establish OGMAs in the Non Contributing Land Base

Costs of establishing OGMAs could be minimized by ensuring they are established in areas of timber that are not contributing to the timber harvesting land base. This is not always done as preferred old growth attributes are sometimes better in timber that is not technically old. By establishing the OGMA in a noncontributing area there is no impact on fixed costs.

3.2.2. Reduction of Age Class

Where the desired natural attributes of the OGMA can be achieved in non-contributing mature timber consideration could be given to recruiting these areas on a priority basis before proceeding with recruitment of old timber in the contributing land base.

3.2.3. Merger of Landscape Units

Some landscape units are quite small and in a deficit position for the recruitment of OGMAs in the non-contributing land base. Adjacent landscape units may have a surplus of the required biogeoclimatic subzone and variant in the non-contributing land base. Where this is the case consideration should be given to merging the landscape units and allowing the combined units to meet the required goals outside the timber harvesting landbase.

3.2.4. Recognition of Protected Areas

Where appropriate recognition of currently protected areas, as contributing to the OGMA goals should be considered.

3.2.5. Merger of Similar Biogeoclimatic Variants

Where biogeoclimatic variants are in the same natural disturbance type and one has a surplus in the noncontributing land base and the other is in a deficit position consideration should be given to merging the two variants. The surplus variant could then fulfill the requirement of the deficit variant from the non-contributing land base.

3.2.6. Establishment of Old Growth Management Areas in Special Management Areas

If possible OGMAs should be located in Special Management Areas on a priority basis rather than in enhanced forestry areas. Special Management Areas already have restrictions on the rate of harvest and therefore the impact the establishment of the OGMA has on available timber and annual allowable cut will be reduced.

3.2.7. Establishment of Old Growth Management Areas

OGMAs should be established with careful consultation between the Ministry of Forests, Ministry of Environment and the companies most impacted. OGMAs should be located in areas where the goals of Landscape Unit Planning are met and the impact on the available timber supply is minimized.

3.2.8. Designate Highly Constrained Landscape Units as High Biodiversity Emphasis Option

Designating highly constrained landscape units for high biodiversity emphasis option management will lessen the impact of that designation on costs in the district overall. Similar to the effect in 3.2.6, if high biodiversity emphasis option designations are established over highly constrained landscape units on a priority basis there will be less volume impact and thus less cost impact in a forest district.

3.2.9. Refine BGB Seral Stage Definitions

In a number of instances there is little naturally occurring old growth within a variant, as defined by the biodiversity guidebook. Furthermore, the ages used for age classes 8 and 9 cover large ranges. A refinement of these definitions to better fit natural age ranges regionally would make more non-contributing area eligible for OGMAs without reducing the intended effect.

4.0 Mechanisms for Mitigating Increased Costs Incurred by Industry

The establishment of WTPs and OGMAs will increase the forest industry's costs of harvesting timber. Cost increases because of the nature of the current appraisal methodology, Comparative Value Timber Pricing, are borne by the forest industry. If the cost impact of WTPs and OGMAs are not to be borne by industry a mechanism to shift these additional costs from industry of government must be adopted.

Comparative Value Pricing is a means of charging specific prices according to the relative value of each stand of timber being sold. Stumpage rates are calculated so that the average rate charged will approximate a target rate (TR) per cubic metre. Even though the relative value of each stand of timber may change due to the introduction of Landscape Unit Planning the target rate is still achieved and thus there is no reduction in revenue to the crown.

If the costs of Landscape Unit Planning are not to be borne by industry an extraordinary mechanism to transfer the additional costs from the forest sector to government must be adopted. Two mechanisms are suggested. A reduction to the target rate or direct cash offset of stumpage payable should be considered.

The actual costs incurred in different landscape units will vary significantly. A suggestion to deal with this variation is also made.

4.1. Target Rate Reduction

The Target Rate is adjusted quarterly by the Ministry of Forests using a predetermined relationship with the Statistics Canada Lumber and Pulp Indices. The average price charged for timber harvested in the interior of the province approximates the Target Rate in any given quarter. If increased costs are to be offset by a reduction in the industries stumpage rates an extraordinary reduction in the relationship between the Target Rate and the Statistics Canada Indices must be made. The Coast and Interior Target Rate calculations would be reduced by the respective estimated average cost increase. The target rate relationship on the coast would be reduced by $\$0.51/m^3$ and in the interior by $\$1.27/m^3$. If implemented these reductions to the target rate relationship would result in no net cost to industry.

4.2. Cash Offset of Stumpage Payable

Direct cash compensation for the increased costs of landscape unit planning could be adopted. A direct reduction in a company's stumpage payable would be a mechanism to achieve the cash offset of increased costs. For each cubic metre of timber harvested a company's cumulative stumpage invoices for all cutting permits harvested in the period could be reduced by the expected increase in costs for the interior or coast respectively. For example, if an interior company harvested one hundred thousand cubic metres and the stumpage invoice is for $2,000,000 the amount payable would be reduced by $\$1.27/m^3$. The amount payable would become $1,873,000. The additional costs of LUP would be directly recovered by this stumpage offset mechanism.

This option has the additional benefit of addressing cutting permits that appraise to minimum stumpage. A Target Rate reduction would not see permits that appraise to minimum rates recover the additional cost of LUP since the stumpage rate would stay at the minimum level. A cash offset applied against a companies total stumpage payable would result in all cutting permits, including those that appraise to minimums, being treated equally. For those few companies who operate only at minimum stumpage a cash payment to offset the additional costs could be considered.

4.3. Varying Costs of Landscape Unit Planning

One of the concerns raised is the varying cost of implementing Landscape Unit Planning across the province. For example the cost of WTPs and OGMAs in a cost class 1 landscape unit in the interior is estimated at $\$0.88/m^3$. By comparison the cost in a landscape unit in cost class 2 with high biodiversity emphasis is estimated to be $\$1.91/m^3$ (Table 6). This is a significant difference. Over time these differences in cost impact will be recognized in the appraisal manual. In the interim consideration could be given to introducing a cost matrix of varying cost estimates by cost class and biodiversity emphasis in the respective coast and interior manuals.

Table 6: Cost Distribution Table

Cost Class	Biodiversity Emphasis	Cost Estimate $/m^3	
		Coast	Interior
1	All	$0.47	$0.88
2	Low	$0.49	$1.03
2	Intermediate	$0.67	$1.50
2	High	$0.72	$1.91

An interior cutting permit situated in a cost class 1 landscape unit would receive a cost estimate of $0.88/m^3. An interior cutting permit in a cost class 2, high biodiversity emphasis unit would receive a cost estimate of $1.91/m^3. The introduction of this table into the appraisal would result in areas with high costs of implementing LUP paying less stumpage than those areas where the costs will be significantly less. The varying cost of implementing LUP would be recognized.

This proposal only addresses the distribution of the cost increase and would have to be implemented concurrently with either a Target Rate reduction or a direct cash offset mechanism if there is to be no net cost to industry.

4.4. Extraordinary Cost Situations – Cost Class 3

As part of this study situations where unusually high cost impacts related to Landscape Unit Planning may occur have been identified. These high cost impacts usually relate to the loss of sunk costs and include:

- Significant abandonment of road development
- Significant abandonment of planning costs
- Forced replacement of equipment to address a new timber profile or logging chance before capital in existing equipment is amortized

These sunk costs have not been included in the calculation of the average cost estimates of LUP. Where it can be proven that significant sunk costs have been lost due to the creation of OGMAs these costs could be estimated independently and directly paid for by an offset against the companies' stumpage billings.

No actual examples of cost class 3 have been identified.

4.5. Timing of Cost Increases

Cost increases are immediate following the implementation of OGMAs and WTPs in a landscape unit, based upon the timing of costs assumption in section 2.1. To the extent that landscape unit planning requirements are phased in over time, the cost increase estimated by this model would track that implementation timing. To the extent that WTP costs are already included in current costs, the WTP related cost for those landscape units will have already occurred and will not increase. The timing of cost impacts was not a part of this study.

Before a reduction to stumpage payable by the forest industry is made the Ministry of Forests should ensure that the June 1, 1998 adjustment to the Target Rate did not account for a portion of the estimated cost increase associated with the establishment of WTP's and OGMA's.

5.0 Costs Not Considered in this Study

Not all costs that the forest industry will incur because of the implementation of Landscape Unit Planning have been included in the calculation of the cost estimates. Those additional costs that would be attributed to annual allowable cut impacts or changes in timber profile have not been included. No attempt has been made quantify the actual magnitude of these costs.

5.1. Annual Allowable Cut Reductions

It has been stated that the impact of landscape unit biodiversity objectives on provincial timber supply will not be permitted to exceed 4.1% in the short-term. While 4.1% will be the average the range will be much more significant. Some areas will see greater changes than others.

Reductions in Annual Allowable Cut (AAC) will result in less available timber and thus additional costs of running existing facilities at less than optimum levels. Fixed costs per cubic metre will increase. This will impact both the sawmills and pulp mills of the province through both lost economic opportunity and economies of scale.

Reductions in AAC make it more difficult for the harvesting work force to work at optimum levels. The Timber Harvesting Contract and Subcontract Regulation can prevent the rationalization of downsized operations and lead to sub-optimal use of high capital equipment. Harvesting equipment is operated most cost effectively when optimum yearly volumes are allocated. Achieving these optimum levels is more difficult with a reduced AAC.

5.2. Changes in Timber Profile

The creation of WTPs and OGMAs can result in a more rapid change in the timber profile than anticipated. The shift to smaller timber, less desirable species and second growth timber can be accelerated by the removal of mature timber from the contributing land base. The timber harvested to replace the volume lost with the creation of WTPs and OGMAs will likely be of less value than the volume it is replacing. Sawmills will have to adjust to this changing profile more quickly than otherwise would be the case. Both equipment and marketing strategy changes will be required.

5.3. Changes in Logging Season

Areas for winter harvesting on the coast and summer harvesting in the interior are in short supply. The establishment of WTPs and OGMAs in these areas will result in higher harvesting costs as the required volume will be shifted into the less desirable season. The additional costs will result from a shorter operating season and increase the costs of carrying inventory.

5.4. Changes in Logging Chance

The creation of OGMAs and WTPs in areas of good logging chance will result in more volume being harvested in less desirable areas. The cost increases include higher tree to truck costs, hauling costs, road construction costs, road maintenance costs and silviculture costs.

5.5. Establishment of Old Growth Management Areas in the Non Contributing Land Base

With the increase in long line and helicopter yarding systems some areas of the non-contributing land base have become desirable candidates for harvesting. These areas may no longer be available as OGMAs are established in the non-contributing land base.

6.0 Conclusions

This report provides:

- cost per cubic meter estimates of implementing WTPs and OGMAs in the interior of the province,
- cost per cubic meter estimates of implementing WTPs and OGMAs in the coastal regions of the province,
- an assessment of opportunities to avoid or lessen the cost impact of implementing these code provisions, and
- mechanisms to transfer the cost to the forest sector of social decisions taken by government from industry to government.

The costs of establishing WTPs and OGMAs are estimated to be:

- $1.27/m^3$ in the interior, and
- $0.51/m^3$ on the coast

Two options have been proposed for the transfer of the cost of implementing Landscape Unit Planning from industry to government:

- Comparative Value Pricing (CVP) is not sensitive to increases in costs. Increases in industries cost structure do not result in a reduction to the crown's revenue. In order that the cost of implementing Landscape Unit Planning not be absorbed by industry the actual CVP formula must be adjusted. The respective coast and interior Target Rate formulas can be adjusted downwards by the estimated costs of establishing WTPs and OGMAs. This would result in no net cost to industry.
- The second option is to offset the estimated costs directly against stumpage payable. A companies cumulative stumpage payable for all cutting permits harvested in a period would be reduced by the expected increase in costs. The expected increase in costs would be calculated by multiplying the volume harvested times the estimated cost impact per cubic meter. Again this would result in no net cost to industry.

Opportunities to avoid or minimize the impacts of implementing these code provisions have been identified. These suggestions need to be evaluated for both the magnitudes of savings and the effect they may have on the goals of the biodiversity guidebook. Some of these suggestions are new and others are already being considered and implemented in some regions of the province. Insuring their consistent application across all regions of the province would reduce the overall cost impact.

Crown Forest Stratification		Incremental Cost ($/m3)	Incremental Fixed Cost ($/m3)		Incremental Variable Cost ($/m3)	Fixed Cost Factor		Fixed Costs (current)		Crown Forest Area	
Cost Class	BEO	fixed & variable	ogma's	wtp's		OGMA factor	WTP factor	Landscape level	Site level	% Total	Strata Total (ha)
Province											
1	all	$0.76		$0.47	$0.29		2.65%		$8.29	28.9%	10,760,775
2	L	$0.87	$0.11	$0.47	$0.29	1.36%	3.15%	$10.55	$5.17	27.1%	10,080,985
2	I	$1.26	$0.50	$0.47	$0.29	5.65%	3.10%	$10.45	$5.48	34.7%	12,922,016
2	H	$1.57	$0.80	$0.47	$0.29	9.23%	3.09%	$10.44	$5.51	9.3%	3,444,712
			$0.28	**$0.47**	**$0.29**	3.18%	2.98%	$10.21	$6.21	100.0%	37,208,487
Province average:		**$1.04**									
Interior											
1	all	$0.88		$0.50	$0.38		3.17%	$10.60	$5.01	19.0%	5,918,533
2	L	$1.03	$0.15	$0.50	$0.38	1.38%	3.17%	$10.60	$5.01	31.7%	9,865,594
2	I	$1.50	$0.62	$0.50	$0.38	5.88%	3.17%	$10.60	$5.01	38.9%	12,084,250
2	H	$1.91	$1.03	$0.50	$0.38	9.69%	3.17%	$10.60	$5.01	10.3%	3,207,280
			$0.39	**$0.50**	**$0.38**	3.72%	3.17%			100.0%	31,075,657
Interior average:		**$1.27**									
Coast											
1	all	$0.47		$0.41	$0.06		2.00%	$8.27	$12.31	79.0%	4,842,241
2	L	$0.49	$0.02	$0.41	$0.06	0.20%	2.00%	$8.27	$12.31	3.5%	215,391
2	I	$0.67	$0.20	$0.41	$0.06	2.40%	2.00%	$8.27	$12.31	13.7%	837,766
2	H	$0.72	$0.25	$0.41	$0.06	3.00%	2.00%	$8.27	$12.31	3.9%	237,431
			$0.04	**$0.41**	**$0.06**	0.45%	2.00%				6,132,830
Coast average:		**$0.51**									

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)

column

- a Cost classs are defined by whether or not OGMAs have an impact on Timber Harvesting Landbase.
  Cost class 1 has no impact on THLB, and cost class 2 requires contibution of area from THLB to meet OGMA target.
- b Biodivesiry Emphasis Option placed upon landscape units during Regional Landscape Unit Planning Strategy exercise.
- c Incremental unit cost ($/m3) expected due to implementation of OGMAs and WTPs for the interior & coast.
- d Portion of incremental unit cost of implementation attributed to impact of OGMAs on fixed portion of current operational cost elements.
- e Portion of incremental unit cost of implementation attributed to impact of WTPs on fixed portion of current operational cost elements.
- f Portion of incremental unit cost of implementation attributed to impact of WTPs on variable portion of current operational cost elements.
- g OGMA factor is the estimated % of THLB required to meet OGMA targets.
- h WTP factor is the estimated % of THLB required to meet OGMA targets.
- I Fixed cost elements considered at the landscape level include all or portions of;
  planning, road infrastructure, camps, mobilization and road maintenance costs.
- j Fixed cost elements considered at the site level include all or portions of planning and road costs.
- k Percentage of forested crown land within each cost strata
- l Area of forested crown land within each cost strata

Appendix 1: Provincial Cost Estimates for Implementation of Wildlife Tree Patches & Old Growth Management Areas

Appendix 2: Cost Pilot Results

2.1 Fixed Cost Elements

Forest Region	Cost Strata		Fixed Cost Increase $/m3	Fixed Costs							Fixed Cost Factors	
				site (wtp) level			landscape (ogma) level					
	cost class	BEO		block roads	block planning	m&d	systems roads	road maintenance	landscape planning	camps	OGMA factor	WTP factor
Prince George	1	all	0.53	1.40	2.84	0.43	7.91	1.53	0.95	0.23		0.035
	2	L	0.54	1.40	2.84	0.43	7.91	1.53	0.95	0.23	0.001	0.035
	2	I	0.98	1.40	2.84	0.43	7.91	1.53	0.95	0.23	0.042	0.035
	2	H	1.44	1.40	2.84	0.43	7.91	1.53	0.95	0.23	0.085	0.035
Nelson	1	all	0.45	1.40	3.53	0.43	7.91	1.49	1.18			0.029
	2	L	0.74	1.40	3.53	0.43	7.91	1.49	1.18		0.027	0.029
	2	I	1.25	1.40	3.53	0.43	7.91	1.49	1.18		0.075	0.029
	2	H	1.60	1.40	3.53	0.43	7.91	1.49	1.18		0.109	0.029
Interior (PG & Nelson)	1	all	0.50	1.40	3.18	0.43	7.91	1.51	1.06	0.12		0.032
	2	L	0.65	1.40	3.18	0.43	7.91	1.51	1.06	0.12	0.014	0.032
	2	I	1.12	1.40	3.18	0.43	7.91	1.51	1.06	0.12	0.059	0.032
	2	H	1.53	1.40	3.18	0.43	7.91	1.51	1.06	0.12	0.097	0.032
Coast (Vancouver)	1	all	0.41	9.51	2.38	0.42	3.52	1.75	3.00			0.020
	2	L	0.43	9.51	2.38	0.42	3.52	1.75	3.00		0.002	0.020
	2	I	0.61	9.51	2.38	0.42	3.52	1.75	3.00		0.024	0.020
	2	H	0.66	9.51	2.38	0.42	3.52	1.75	3.00		0.030	0.020

2.2 Variable Cost Elements

Forest Region	Total Variable Cost ($/m3)	Planning Cost Change	Planning Cost Elements				Road Cost Change	Road Cost Elements		
		LUP Impact ($/m3)	spatial analysis	rework fdp's	site plan detail	abandoned planning costs	unit cost LUP impact	addl road in LU	incremental dev costs	abandoned development
Prince George	0.101	0.080	0.060		0.020					
Nelson	0.667	0.230	0.111		0.102		0.079		0.079	
Interior (PG & Nelson)	0.384	0.155	0.086		0.061		0.040		0.040	
Coast (Vancouver)	0.060	0.060	0.030		0.030					

Forest Region	cont...	Fall/Skid Cost Change					Haul Cost Change	Haul Cost Elements	
		unit cost LUP impact	alternate method	cable roductivi	longer distance	falling productivity	unit cost LUP impact	addl haul dist	sub optimal route
Prince George		0.021				0.021			
Nelson		0.358		0.346		0.021			
Interior (PG & Nelson)		0.189		0.173		0.021			
Coast (Vancouver)									

Appendix 3: Landscape Unit Stratification

Stratification		%	(ha)						
Cost Class	BEO		Total	PRFR	PGFR	CFR	KFR	NFR	VFR
	4								
Province									
1	all	28.9%	10,760,775	1,354,003	3,145,546	735,138	516,005	761,601	4,248,481
2	L	27.1%	10,080,985	541,814	4,908,358	1,686,870	1,635,675	1,095,093	213,174
2	I	34.7%	12,922,016	306,523	6,673,043	2,134,108	1,704,557	1,266,430	837,355
2	H	9.3%	3,444,712	62,018	1,749,311	567,647	430,726	397,578	237,431
			37,208,487	2,264,358	16,476,259	5,123,763	4,286,964	3,520,702	5,536,442
Interior									
1	all	19.0%	5,918,533	760,243	3,145,546	735,138	516,005	761,601	
2	L	31.7%	9,865,594	539,597	4,908,358	1,686,870	1,635,675	1,095,093	
2	I	38.9%	12,084,250	306,112	6,673,043	2,134,108	1,704,557	1,266,430	
2	H	10.3%	3,207,280	62,018	1,749,311	567,647	430,726	397,578	
			31,075,657	1,667,970	16,476,259	5,123,763	4,286,964	3,520,702	
Coast									
1	all	79.0%	4,842,241	593,760					4,248,481
2	L	3.5%	215,391	2,217					213,174
2	I	13.7%	837,766	411					837,355
2	H	3.9%	237,431						237,431
			6,132,830	596,388					5,536,442

	2	1	1	1	2	1

footnotes:

1 from RLUPS district summary (complete)

2 from RLUPS district summary (partial)

3 from regional or provincial averages

4 biodiversity emphasis option

Appendix 4: Cost Pilot Participants

Prince George Cost Pilot		
Walter Matosevic	Canfor Corp Ltd	Chief Forester
Ken Pedersen	Canfor Corp Ltd Canfor	Area Manger
Jeff Burrows	BC Ministry of Forests	PGFD - planning
Les Hawkins	BC Ministry of Forests	PGFR -inventory, valuation
Kootenay Lake Cost Pilot		
Dale Anderson	BC Ministry of Forests	KLFD - planning
Mike Knapik	BC Ministry of Environment	Forest Ecosystem Specialist
Scott Rockly	BC Ministry of Forests	KLFD - valuation
Lloyd Havens	Crestbrook Forest Industries	Planning Manager
Jack Marra	Crestbrook Forest Industries	Area Manager
Dennis Rounsville	Crestbrook Forest Industries	Chief Forester
Vancouver Region Cost Pilot		
Harry Barrett	Interfor Ltd	Area Manager
Laszlo Kardos	Interfor Ltd	Administrative Forester
Wayne Wall	Interfor Ltd	Wildlife Biologist
Ron Deiderichs	BC Ministry of Environment	Forest Ecosystem Specialist
John Andres	BC Ministry of Forests	Campbell River Forest District
Rudy Maser	BC Ministry of Forests	Vancouver Region
Patrick Bryant	Canfor Corp Ltd	Inventory Forester
John Deal	Canfor Corp Ltd	Habitat Forester
Rob Woodside	Canfor Corp Ltd	Planning & Development Manager
Consultants		
Jim Burbee	Venture Forestry Consulting Inc	
Steve Potter	Impact Forest Solutions	